Electrical Conductivity Protocol

Purpose

To measure the conductivity of the water at the Hydrology Study Site

Overview

Conductivity is a measure of the amount of total dissolved solids in the water.

Time

5 minutes

Level

All

Frequency

Weekly including calibration

Key Concepts

Conductivity, factors affecting conductivity
Standardization, calibration
Accuracy, Precision

Skills

Using a conductivity meter
Recording data

Materials and Tools

Total dissolved solids tester (or conductivity tester)
Standard solution
Distilled water
Squeeze bottle
Soft tissue
Three 50 mL or 100 mL beakers
Jewelry screwdriver (for calibration)

Preparation

Perform the *Calibration* procedure below. Bring the tools and materials to the water site.

Prerequisites

None

Note: this measurement is for freshwater only. For salt and brackish waters measure salinity instead.

Background

Conductivity is measured in microSiemens/centimeter (μS/cm). A microSiemen is the same as a micromho.

Conductivity of a water sample is a measure of its ability to carry an electric current. The more impurities (total dissolved solids) in water, the greater its electrical conductivity. By measuring the conductivity of a water sample, the amount of total dissolved solids in the sample can be determined. To convert the electrical conductivity (microSiemens/cm) of a water sample to the concentration of total dissolved solids (ppm) in the sample, the conductivity must be multiplied by a factor of between 0.54 and 0.96 for natural waters. The value of this factor depends upon the type of dissolved solids. A widely accepted value to use when you are not determining the type of dissolved solids is 0.67.

TDS (ppm) = Conductivity (microSiemens/cm) x 0.67

Calibration

The conductivity meter should be calibrated before each set of measurements. Before use and every six months the temperature compensation should be checked. Calibration standards should be replaced annually.

Calibration

1. The standard solution should be tightly capped and kept refrigerated. The label on the bottle in which the solution is stored should include the date on which the solution was made or purchased.

2. Remove the cap from the meter.
3. Line up two clean and dry 100 mL beakers and fill each beaker with just enough standard solution to immerse the electrode. Note: Other standard solutions are available and acceptable. Please calibrate instrument accordingly.
4. Press the ON/OFF button to turn the tester ON.
5. Rinse the electrode (at the bottom tip of the pen) with distilled water from a squeeze bottle. Do not rinse above the brown line. Blot it dry with a soft tissue.
6. Immerse the electrode in the first beaker of standard solution for a second or two. Take the meter out of the first beaker and dip it into the second standard solution beaker, without rinsing the electrode. See Figure HYD-P-4.
7. Gently stir for a few seconds, then allow the display value to stabilize.
8. If the display does not read the standard value, you must adjust the instrument to read this number. Using a small screwdriver, adjust the calibration screw on the pen until the display reads the standard value. Note: Some conductivity meters may have different adjustments.
9. Discard the standard solution that was used in the two beakers. Do not return the standard solution used in this procedure to its original bottle!
10. Rinse the electrode with distilled water and blot it dry. Rinse the beakers thoroughly.
11. Press the ON/OFF button to turn the meter off. Cap the meter.

Temperature Compensation Check

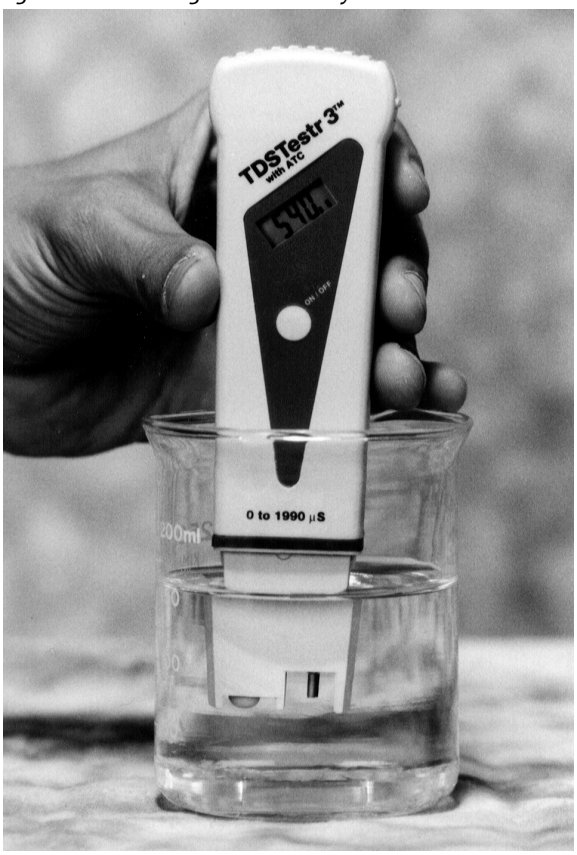
Conductivity measurements are affected by the water sample temperature. Your meter should be temperature compensated to give a conductivity reading equivalent to a temperature of 25° C.

Measure the conductivity of your standard at 5, 15, 25, and 35° C. If the conductivity reading is outside the specified range (+/– 40 µS/cm) for your standard at 25° C, then contact the manufacturer.

Quality Control in the Field

Whether the tester is calibrated in the classroom or in the field, the standard solution must be tested with the following protocol as if it were a water sample. When tested the standard should read its true value. If it does not, the instrument must be recalibrated, and the conductivity measurement made again.

Figure HYD-P-4: Using the Conductivity Meter



How to Measure Conductivity

1. Remove cap from the meter and press the ON/OFF button to turn the tester on.
2. Rinse the electrode with distilled water and blot it dry.
3. Fill a clean, dry, 100 mL beaker with water to be tested.
4. Immerse the electrode in the water sample. See Figure HYD-P-4.
5. Gently stir the sample for a few seconds, then allow the display value to stabilize.
6. Read the display value and record its value on the Hydrology Investigation Data Work Sheet.
7. Take the average of the electrical conductivity values measured by the student groups. If the recorded values are all within 40 microSiemens/cm of the average, report the average value to the GLOBE Student Data Server. If you have more than three groups and there is one outlier (a value far different from the rest), discard that value and calculate the average of the other values. If they are now all within 40 microSiemens/cm of this new average, report this new average to the GLOBE Student Data Server. If there is a wide scatter in results, discuss the procedure and the potential sources of error with the students, but do not report a value to the GLOBE Student Data Server. Repeat the protocol if possible to produce a reportable measurement.